



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023**

COURSE NAME : HYDROLOGY

COURSE CODE : DAC 21502

PROGRAMME CODE : DAA

EXAMINATION DATE : FEBRUARY 2023

DURATION : 2 HOURS 30 MINUTES

INSTRUCTION : 1. ANSWER FIVE (5) QUESTIONS ONLY.

2. THIS FINAL EXAMINATION CONDUCTED VIA **CLOSE BOOK**

3. STUDENT ARE PROHIBITED TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSE BOOK

THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

Q1 (a) List **two (2)** types of watershed areas

(2 marks)

(b) Explain the following:

(i) Water budget equation

(2 marks)

(ii) Precipitation

(2 marks)

(iii) Evapotranspiration

(2 marks)

(c) The storage of reservoir at a specified time is 3 hectare-meters. At the same instant, the inflow is $15 \text{ m}^3/\text{s}$ and the outflow $20 \text{ m}^3/\text{s}$. One hour later, the inflow is $20 \text{ m}^3/\text{s}$ and the outflow is $20.5 \text{ m}^3/\text{s}$.

(1 hectare = 10000 m^2)

(i) Determine the change in storage of reservoir that occurred during the hour (m^3).

(5 marks)

(ii) Is the storage at the end of the hour greater of less than the initial value?

(2 marks)

(iii) What is the storage at the end of the hour (m^3)?

(3 marks)

(iv) What is the storage at the end of the hour (m)?

(2 marks)

Q2 (a) List **two (2)** type of rain gauges.

(2 marks)

(b) Elaborate the general types of precipitation.

(6 marks)

(c) **Table 2(c)** shows rainfall record for April at station C, D, E located nearby station X. Annual average rainfall for all stations are also given. Calculate the rainfall at station X in April.

(4 marks)

(d) By referring the **Table 2(d)**, Calculate the average precipitation using Thiessen Polygon method.

(8 marks)

Q3 (a) State **two (2)** factors affecting the infiltration process.

(2 marks)

(b) Elaborate the Flooding Type Infiltrometer as equipment in measuring infiltration rate.

(6 marks)

(c) By referring to **Table Q3(c)**, the value of direct runoff depth is 59 mm. Calculate the following:

(i) Φ index (mm/hr)

(8 marks)

(ii) Precipitation excess (mm).

(4 marks)

Q4 (a) Write **two (2)** factors affecting runoff capacity in the water channel.

(2 marks)

(b) Summarize **three (3)** limitations of Rational Method in estimating peak flow.

(6 marks)

(c) By referring to **Table Q4(c)**, calculate the composite runoff coefficient.

(4 marks)

(d) By referring to **Figure Q4(d)**, assume that the stream is flowing bank full with 0.5% of the slope. Calculate the following:

(i) Wetted area (ft²).

(2 marks)

(ii) Wetted perimeter (ft).

(2 marks)

(iii) Hydraulic radius (ft). (2 marks)

(iv) Velocity (ft/s) in the stream. (2 marks)

Q5 (a) Describe surface runoff as a major component of the water cycle. (2 marks)

(b) Give **two (2)** methods in derivation of Unit Hydrograph. (2 marks)

(c) Explain the characteristics of staff in measuring water surface elevation. (4 marks)

(d) Referring to **Table Q5(d)**, the time interval is an hour between readings for a storm hydrograph with the corresponding excess rainfall. Determine:

(i) Total number of DRO ordinates. (2 marks)

(ii) Value of UH Ordinates ($m^3/s.mm$). (10 marks)

Q6 (a) State **two (2)** types of zones in an unconfined aquifer. (2 marks)

(b) Elaborate groundwater parameters storage.

(6 marks)

(c) By referring to **Table Q6(c)**, determine the discharge (m^3/s) from the well.

(12 marks)

Q7 (a) Recognize flood routing which is related to flow rate and flow depth.

(2 marks)

(b) Clarify Pulse Method which is applied in reservoir routing.

(6 marks)

(c) By referring to **Table Q7(c)**, calculate:

(i) Storage ($\text{ft}^3/\text{s} - \text{day}$) in reservoir.

(4 marks)

(ii) Outflow (ft^3/s) which the length of the spillway is 35 ft.

(4 marks)

(iii) Final discharge (ft^3/s) based on the water elevation.

(4 marks)

- END OF QUESTIONS -

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Table 2 (c)

Station	Rainfall April (cm)	Annual Rainfall (cm)
X	?	115
C	12.5	125
D	14.5	145
E	19.9	130

Table 2(d)

Station	Rainfall (mm)	Area (km ²)
A	530	2
B	740	11
C	730	4
D	860	14
E	930	8
F	922	12
G	1087	12
H	954	2

Table Q3(c)

Time (hr)	1	2	3	4	5
Rainfall Intensity (mm/hr)	39	95	55	37	15

Table Q4(c)

Surface Type	Area (acre)	Runoff Coefficient, C
Commercial properties	19	0.15
Residential areas	31	0.35
Grass areas	39	0.3
Forested areas	17	0.75

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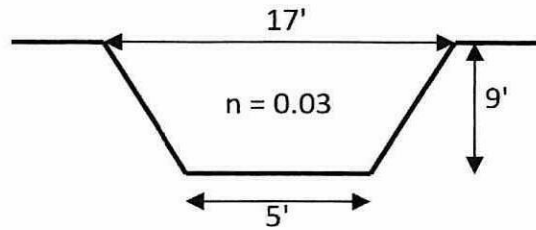


Figure Q4(d)

Table Q5(d)

Time (hour)	Rainfall Excess (mm)	Direct Discharge (m^3/s)
1	15	15
2	25	100
3		290
4		560
5		670
6		325

Table Q6(c)

Item	Value
Hydraulic conductivity	10500 m/min
Radial distance from observation well 1 to pumped well	0.035 km
Drawdown at observation well 1	9 m
Radial distance from observation well 2 to pumped well	7500 cm
Drawdown at observation well 2	7 m
Aquifer thickness	77 m

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COURSE CODE : DAC 21502**Table Q7(c)**

Head, H (ft)	Storage (Acre-ft)
0	311
1	331
2	355
3	359
4	371
5	375
6	393
7	399

LIST OF FORMULA

$$\Phi \text{ index} = (P - R) / t$$

$$R = A / P$$

$$v = 1.49/n \times R^{2/3} \times s_0^{1/2}$$